CLAIMS

1. A method of forming a flow field plate, said flow field plate comprising a network of flow passages formed therein, wherein said method comprises:

arranging an electromagnetic actuator opposite a profiled surface of a die portion, wherein said profiled surface of said die portion is configured to at least partially define said network of flow passages, and wherein said electromagnetic actuator is configured to generate a magnetic field upon activation;

positioning a sheet of material between said electromagnetic actuator and said profiled die surface, wherein said sheet of material is characterized by a conductivity sufficient to yield a repulsive electromagnetic force between said actuator and said sheet upon activation of said actuator; and

forming said network of flow passages in said sheet by driving said electromagnetic actuator such that said repulsive force is of sufficient intensity to deform said sheet against said profiled die surface.

2. A method of forming a flow field plate as claimed in claim 1 wherein said electromagnetic actuator is driven such that said repulsive force is of sufficient intensity to yield a strain rate of at least about 100 sec^{-1} in said sheet.

3. A method of forming a flow field plate as claimed in claim 1 wherein said electromagnetic actuator is driven such that said repulsive force is of sufficient intensity to yield a deformation velocity of at least about 50 m/s.

4. A method of forming a flow field plate as claimed in claim 1 wherein said network of flow passages is distributed substantially uniformly across a majority of said flow field plate.

5. A method of forming a flow field plate as claimed in claim 1 wherein said network of flow passages includes a plurality of supply inlets in communication with a common supply manifold and a plurality of exhaust outlets in communication with a common exhaust manifold.

6. A method of forming a flow field plate as claimed in claim 1 wherein said network of flow passages define respective lands along a planar face of said flow field plate between adjacent ones of said flow passages, said lands collectively defining said planar face of said flow field plate.

7. A method of forming a flow field plate as claimed in claim 1 wherein said flow passages are characterized by a flow passage depth at least twice as large as a thickness of said sheet of material.

8. A method of forming a flow field plate as claimed in claim 7 wherein said sheet of material is characterized by a thickness of less than about 1 mm.

9. A method of forming a flow field plate as claimed in claim 1 wherein said flow passages are characterized by a flow passage depth at least 3 times as large as a thickness of said sheet of material.

10. A method of forming a flow field plate as claimed in claim 9 wherein said sheet of material is characterized by a thickness of less than about 1 mm.

11. A method of forming a flow field plate as claimed in claim 1 wherein said sheet of material comprises aluminum or an aluminum alloy.

12. A method of forming a flow field plate as claimed in claim 1 wherein said sheet of material comprises steel, magnesium, or combinations thereof.

13. A method of forming a flow field plate as claimed in claim 1 wherein said sheet of material comprises a metal alloy having a density of below about 5 g/cm^3.

14. A method of forming a flow field plate as claimed in claim 1 wherein said sheet of material comprises a metal or metal alloy characterized by a density substantially less than that of carbon steel, stainless steel, ingot iron, ductile cast iron, malleable iron, and other materials of comparable density.

15. A method of forming a flow field plate as claimed in claim 1 wherein said sheet of material comprises a target sheet of relatively low conductivity and a driver sheet of relatively high conductivity.

16. A method of forming a flow field plate as claimed in claim 15 wherein said driver sheet is interposed between said target sheet and said electromagnetic actuator.

17. A method of forming a flow field plate as claimed in claim 15 wherein said target sheet is interposed between said driver sheet and said profiled die surface.

18. A method of forming a flow field plate, said flow field plate comprising a network of flow passages formed therein, wherein said method comprises:

arranging an electromagnetic actuator opposite a profiled surface of a die portion, wherein said profiled surface of said die portion is configured to at least partially define said network of flow passages such that said network of flow passages is distributed uniformly across a majority of said flow field plate defining a serpentine path across a face of said flow field plate, said network of flow passages includes a plurality of supply inlets in communication with a common supply manifold and a plurality of exhaust outlets in communication with a common exhaust manifold, said network of flow passages define respective lands along a planar face of said flow field plate between adjacent ones of said flow passages, said lands collectively defining

said planar face of said flow field plate, said network of flow passages are characterized by a flow passage depth at least three times as large as a thickness of said sheet of material;

positioning a sheet of material between said electromagnetic actuator and said profiled die surface, wherein

said electromagnetic actuator is configured to generate a magnetic field upon activation,

said sheet of material comprises a metal or metal alloy characterized by a density substantially less than that of carbon steel, stainless steel, ingot iron, ductile cast iron, malleable iron, and other materials of comparable density, and

said sheet of material is characterized by a conductivity sufficient to yield a repulsive electromagnetic force between said actuator and said sheet upon activation of said actuator; and

forming said network of flow passages in said sheet by driving said electromagnetic actuator such that said repulsive force is of sufficient intensity to deform said sheet against said profiled die surface.

19. An apparatus for forming a flow field plate, said flow field plate comprising a network of flow passages formed therein, said apparatus comprising a die portion, an electromagnetic actuator, and a conductive frame, wherein:

said die portion defines a profiled surface;

said profiled surface of said die portion is configured to at least partially define said network of flow passages;

said electromagnetic actuator is arranged opposite said profiled surface of said die portion; and

said conductive frame is configured to

secure said sheet of material in electrical contact with said conductive frame in a position between said electromagnetic actuator and said profiled die surface,

permit formation of said network of flow passages in said sheet through deformation of said sheet of material against said profiled die surface upon activation of said electromagnetic actuator, and

define a return path for eddy currents induced in said sheet of material upon activation of said electromagnetic actuator.